DEVELOPMENT OF A METHOD FOR EVALUATING THE THERMAL PERFORMANCE OF FIRE FIGHTERS' PROTECTIVE CLOTHING

by

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Abstract

Fire fighters' protective clothing has steadily improved over the years as new materials and improved designs have reached the market. A significant catalyst that has brought these improvements to the fire service is the National Fire Protection Association (NFPA) 1971 standard on structural fire fighters' protective clothing. The fabric flammability test in this standard has resulted in the development of protective garments that resist flaming ignition. The Thermal Protective Performance (TPP) test has assisted in the development of garments that protect fire fighters from short duration, high intensity, flash fire exposures. These two thermal tests methods have clearly lead to improvements in fire fighter safety. However, thousands of fire fighters are continuing to be seriously burned each year. Feedback from the fire service has shown that many of these serious burn injuries are occurring when fire fighters are exposed to thermal environments that are significantly less intense than those addressed in the NFPA standard. Therefore, the National Institute of Standards and Technology (NIST) has developed a method for measuring the thermal performance of fire fighters' protective clothing under thermal conditions less severe than those currently found in NFPA 1971.

This report describes a test apparatus and method for evaluating the thermal performance of fire fighters' protective clothing. The test method provides a means for making temperature measures through the various layers that make up a fire fighter's thermal protective garment. Temperature measurements are made at the surface of the outer shell, at locations between fabric or moisture barrier layers inside the protective clothing system, and at the thermal liner surface where the fire fighter's body would be in contact with the garment. When plotted, these temperature measurements show a detailed picture of how a protective clothing system performs when exposed to a given thermal environment. This method's thermal environment may be varied from a radiant flux representative of outdoor conditions on a hot sunny day to conditions that replicate a post-flashover fire. The test method may be used for measuring the effects of moisture in protective clothing systems. In addition, this method provides a means for measuring the amount of thermal energy stored in a protective clothing system. Test duration may range from several seconds to more than 30 minutes.

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